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PATENT SPECIFICATION

DRAWINGS ATTACHED

1,164,147

Inventors: WILLIAM MAURICE LOWE and THOMAS RAINE

Date of filing Complete Specification: 8 November, 1967.

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COMPLETE SPECIFICATION

Improvements in Cutting Tools with Replaceable Tips

We, METRO-CUTANIT LIMITED, a British

PATENTS ACT 1949

SPECIFICATION NO 1164147

The following amendment was allowed under Section 29 on 4 June 1973

Page 1, line 24, *after use. insert* One suitable form of tool holder is described in British Patent Specification No 831244

THE PATENT OFFICE
6 July 1973

R 70360

-- Since the forces set up on the tip are transmitted to the support which carries it, it is most important that the tip shall be rigidly connected to the support and that the tip shall not become loose in use.

25 An object of the present invention is the provision of improved cutting tools with replaceable cutting tips.

Accordingly the invention consists in a cutting tool having a replaceable cutting tip carried by a support in a recess therein having an open end and defined by a flat base flanked by at least one load-bearing shoulder against which the tip may abut while resting on the base of the recess and presenting an effective cutting edge at the open end of the recess, and locking means for removably securing the cutting tip to the support comprising a sleeve rotatably located in a bore in the support and extending substantially normally away from the base of the recess, in combination with a pin which engages with a hole in the tip and is located in part in the bore of said sleeve on an axis eccen-

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The invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a plan view of a turning tool with a replaceable tip;

Figure 2 is a sectional side elevation of the tool shown in Figure 1, taken on the line II-II of that Figure and as viewed in the 70 direction indicated by the arrows.

Figure 3 is a diagram showing a plan view of an arrangement generally similar to Figure 1, but enlarged and modified to illustrate a preferred locking action of the tool 75 tip;

Figures 4, 5 and 6 show simplified diagrams of examples of a milling cutter with removable cutting tips;

Figure 4 is a part of an end elevation of 80 the milling cutter;

Figure 5 is a partial section on Figure 4; and

Figure 6 is an end elevation of a modification.

Referring to Figures 1 and 2, the tool com-

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COMPLETE SPECIFICATION

Improvements in Cutting Tools with Replaceable Tips

We, METRO-CUTANIT LIMITED, a British Company having its registered office Grappinhall, Warrington, Lancashire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention relates to cutting tools, including turning and boring tools and milling cutters, with replaceable cutting tips. It is common practice today to utilise cutting tools having a cutting tip removably secured to a support. For example, known types of turning and boring tools may consist of a carbon steel shank of rectangular cross-section, by which the tool is clamped in place in a tool holder, and a tungsten carbide tip secured to the shank at one end. Since the forces set up on the tip are transmitted to the support which carries it, it is most important that the tip shall be rigidly connected to the support and that the tip shall not become loose in use.

An object of the present invention is the provision of improved cutting tools with replaceable cutting tips.

Accordingly the invention consists in a cutting tool having a replaceable cutting tip carried by a support in a recess therein having an open end and defined by a flat base flanked by at least one load-bearing shoulder against which the tip may abut while resting on the base of the recess and presenting an effective cutting edge at the open end of the recess, and locking means for removably securing the cutting tip to the support comprising a sleeve rotatably located in a bore in the support and extending substantially normally away from the base of the recess, in combination with a pin which engages with a hole in the tip and is located in part in the bore of said sleeve on an axis eccen-

tric to the sleeve, whereby when the sleeve is rotated with respect to the support it causes the pin to move the cutting tip in a direction transverse to the pin axis and in clamping engagement with the load-bearing shoulder or shoulders of the support.

Preferably the support has first and second load bearing shoulders angularly disposed with respect to each other and rotation of the sleeve causes the tip to be moved by the pin into clamping engagement with said first load bearing shoulder before clamping engagement the second load bearing shoulder.

This effect is obtained by locating the intersection point of the sleeve axis and the base of the recess offset from the bisector of the angle included between the two load bearing shoulders.

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a plan view of a turning tool with a replaceable tip;

Figure 2 is a sectional side elevation of the tool shown in Figure 1, taken on the line II-II of that Figure and as viewed in the direction indicated by the arrows.

Figure 3 is a diagram showing a plan view of an arrangement generally similar to Figure 1, but enlarged and modified to illustrate a preferred locking action of the tool tip;

Figures 4, 5 and 6 show simplified diagrams of examples of a milling cutter with removable cutting tips;

Figure 4 is a part of an end elevation of the milling cutter;

Figure 5 is a partial section on Figure 4; and

Figure 6 is an end elevation of a modification.

Referring to Figures 1 and 2, the tool com-

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prises a support 1 which, in the case of a boring or turning tool, may be a shank formed from 0.5% carbon steel and for the most part of square cross section. At one end support 1 is cut away to form a flat face 3 defining with shoulders 5 and 7 an open ended recess 9 in which the cutting tip 21 may be seated so as to present an effective cutting edge the side face of the tip disposed at the open end of the recess. The face 3 and the flanking shoulders 5 and 7 of the recess will, in operation, take the cutting load to varying degrees. Substantially normal to the face 3 the support 1 is drilled to form the bore 11, which for most of its length is of constant diameter to form the bore part 11A but which for its lower part is of lesser diameter to form the bore part 11B, so leaving the annular flange or shoulder 13. A cylindrical sleeve 15 of high tensile steel, which is a sliding and rotatable fit in the bore part 11A, is positioned in that bore part and rests on the shoulder 13. The lower end of the sleeve 15 is formed with a recess 17 of hexagonal cross section to accept an ALLEN key (not shown) by which the sleeve can be rotated. The upper end of the sleeve 15 is formed with an axially extending hole 19 the axis of which is eccentric with respect to the axis of the sleeve. The tool tip 21 is provided with a central hole 23 having a diameter equal to that of the hole 19, and a securing pin 25 of drill steel is located in the holes 19 and 23, in which it is a sliding and rotatable fit.

The tool tip 21 is assembled to the support 1 by rotation of the sleeve 15 by means of the Allen key, inserted into the recess 17, until the axis of the pin 25 is sufficiently displaced from the corner where shoulders 5 and 7 meet to allow the fitting of the tip onto the upper end of pin 25. The sleeve 15 is then rotated by means of the Allen key and the pin 25 is thus moved to slide the tip over the face 3 transversely to the pin axis to force at least one of the edges of the tip 21 firmly into clamping engagement with at least one of the load-bearing shoulders 5 and 7. Although locking against one load bearing shoulder may be obtained by suitable dimensioning of the parts and may be adequate in some cases, it is preferred to lock against two load bearing shoulders so that the total load may be shared by these in conjunction, of course, with the load bearing face 3. In tools of the type being described, when it is required to have two abutment shoulders, a greater part of the cutting load may be taken by one of the shoulders than is taken by the other. It has been found that the eccentricity of the pin 25 and sleeve 15 and the position of the sleeve with respect to the face 3 may be so chosen that locking is obtained against one shoulder slightly before the other. For this purpose it is

of very considerable advantage to displace the centre line of the hole in the shank very slightly nearer one of the two abutment shoulders on the shank, such that when the locking sleeve 15 is rotated one side of the tip makes contact with one of the two shoulders and further locking action causes the tip to move along that shoulder until the other side of the tip locks against the second shoulder which is at right angles to the first shoulder. The amount of the displacement of the centre line of the hole in the shank need only be a very small amount of the order of a few thousandths of an inch. It is also preferred that this displacement from true central position should be towards the abutment shoulder which takes the main component of cutting force when the tool is in operation. Thus referring to Figures 1 and 2, the centre line of the bore 11 in the shank should be very slightly nearer shoulder 5 than it is to shoulder 7.

This locking effect is illustrated on a greatly exaggerated scale in Figure 3, where it is seen that the axis X_2 of the bore 11 and sleeve 15 is non-coincident with the bisector a-b of the angle, in this case a right-angle, included between the shoulders 5 and 7. X_1 indicates the axis of the pin 25. Assuming that the sleeve is then rotated clockwise as seen in Figure 3, clamping engagement can be obtained with shoulder 5 just before shoulder 7. Further rotation of the sleeve causes the tip to slide along shoulder 5 until clamping engagement is made with shoulder 7.

When locking has been obtained in the manner described, additional rotation of the sleeve will not shift the tip but will cause a frictional locking force to be set up between the support 1, the sleeve 15 and the pin 25. No other locking of the sleeve is therefore required.

Although the example has been described above with reference to a turning or boring tool, the invention is not restricted thereto and is applicable to other metal removing tools, e.g. milling cutters.

One such arrangement is shown in Figures 4 and 5. A number of slots 26 are machined at regular intervals around a cylindrical body 10 of an axially rotatable milling cutter at an angle to suit the requirements. These slots are so shaped as to provide load bearing surfaces 43, 45, 47 equivalent, for example, to surfaces 3, 5 and 7 of Figures 1 to 3. The second shoulder 47 may, in some cases, not be necessary. In other cases it may be formed by a fixed stop or by an adjustable stop. These alternatives are obtained by the machining of suitable recesses in the milling cutter body. An adjustable shoulder in the position of shoulder 47 is desirable where the cutting tips in the holder have to be positionally disposed with high accuracy rela-

tive to each other. Such an adjustable shoulder 48 is shown diagrammatically in Figure 6. The locking pin 55 and sleeve 15 act in a similar manner as are the single-point tool construction previously described to lock the cutting tip 41 against the abutments. The slots are in all cases machined to provide a clearance space for the cuttings and to provide access either from the rear, or from the side at the rear end, of the bore to a recess 57 for a locking key. The shoulder 48 is shown as adjustable by means of a spigot 50 and slot 51 in the holder. The shoulder 48 may, however, be made adjustable in two or more directions where high accuracy is required. The milling cutter could equally well be made up by inserting and securing in recesses formed in the circular holder an appropriate number of sub-holders with the tips already locked in position in the sub-holders.

A wear resistant support pad may in all cases, be used in known manner between the cutting tip and the base of the recess.

It will be appreciated that the recessed end of the shank 1 and the locking components are all suitably hardened after machining to the shapes shown, and it is found that the shank and the locking components can outlast several of the replaceable tips 21. The end of the pin 25 located in the hole 23 in the tip may be barrel shaped instead of a right cylinder.

WHAT WE CLAIM IS:

1. A cutting tool having a replaceable cutting tip carried by a support in a recess therein having an open end and defined by a flat base flanked by at least one load-bearing shoulder against which the cutting tip may abut while resting on the base of the recess and presenting an effective cutting edge at the open end of the recess, and locking means for removably securing the cutting tip to the support comprising a sleeve rotatably located in a bore in the support and extending substantially normally away from the base of the recess, in combination with a pin which engages with a hole in the tip and is located in part in the bore of said sleeve on an axis eccentric to the sleeve, whereby when the sleeve is rotated with respect to the support it causes the pin to move the cutting tip in a direction transverse to the pin axis and in clamping engagement with the load-bearing shoulder or shoulders of the support.

2. A cutting tool according to the preceding Claim wherein the support has first and second load-bearing shoulders angularly disposed with respect to each other and rotation of the sleeve causes movement of the pin into clamping engagement with said first load-bearing shoulder before clamping engagement with the second load-bearing shoulder.

3. A cutting tool according to Claim 2 wherein the point of intersection of the axis of the sleeve and the base of the recess is slightly offset from the bisector of the angle included between the two load-bearing shoulders.

4. A cutting tool according to Claim 2 or Claim 3 wherein the tip and the base of the recess are substantially square in plan and the two load bearing shoulders are substantially at right angles to each other.

5. A cutting tool according to any preceding Claim in which the end of the sleeve remote from the base of the recess is formed to accept a socket key and is accessible from this side of the support.

6. A cutting tool according to any preceding Claim in which the end of the sleeve remote from the base of the recess bears upon a flange of the bore in the support and is accessible from that end for rotation.

7. A cutting tool according to any preceding Claim wherein the said support comprises a substantially cylindrical milling cutter body which is rotatable about its longitudinal axis and is provided with a number of the recesses at spaced intervals along its periphery to provide for each of a similar number of cutting tips a base on which the tip may rest and one or more load-bearing shoulders with which the tip can be moved into clamping engagement by the locking means for removably securing the cutting tip to the cutter body.

8. A milling cutter having a plurality of replaceable cutting tips carried in respective open recesses in a substantially cylindrical cutter body which is rotatable about its longitudinal axis, said recesses being spaced at intervals along the cylindrical periphery of said body and each recess being defined by a base flanked by at least one load-bearing shoulder against which the cutting tip may abut while presenting an effective cutting edge at the open end of the recess, and locking means for removably securing the cutting tip to the cutter body comprising a sleeve rotatably located in a bore in the cutter body and extending substantially normal to the base of the recess, in combination with a pin which engages with a hole in the tip and is located in part in the bore of said sleeve on an axis eccentric to the sleeve, whereby when the sleeve is rotated with respect to the cutter body it causes the pin to move the cutting tip in a direction transverse to the pin axis and in clamping engagement with the load-bearing shoulder or shoulders of the cutter body.

9. A milling cutter according to Claim 7 or Claim 8 wherein at least one of the load-bearing shoulders is formed by an adjustable member having a portion thereby slidably adjustable and lockable in a bore in the cutter body.

10. A milling cutter according to Claim 7 or Claim 8 or Claim 9 wherein the bases of the recesses on which respective cutting tips can rest lie in planes substantially parallel to the axis of rotation of the cutter body.

11. A milling cutter according to any of Claims 7, 8, 9 and 10 wherein a number of sub-holders with the cutting tips assembled and locked therein are securable in respective slots or recesses circularly distributed around the axis of rotation of the milling cutter body.

12. A cutting tool with a replaceable cutting tips removably secured thereto substantially as hereinbefore described with reference to Figures 1, 2 and 3 of the accompanying drawings.

13. Milling cutters having replaceable cutting tips removably secured thereto substantially as hereinbefore described with reference to Figures 4, 5 and 6 of the accompanying drawings.

J. W. RIDDING,

Chartered Patent Agent.
Agent for the Applicant.

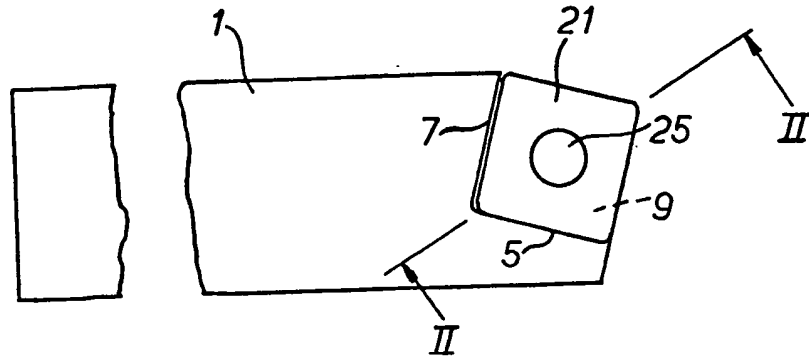


FIG. 1

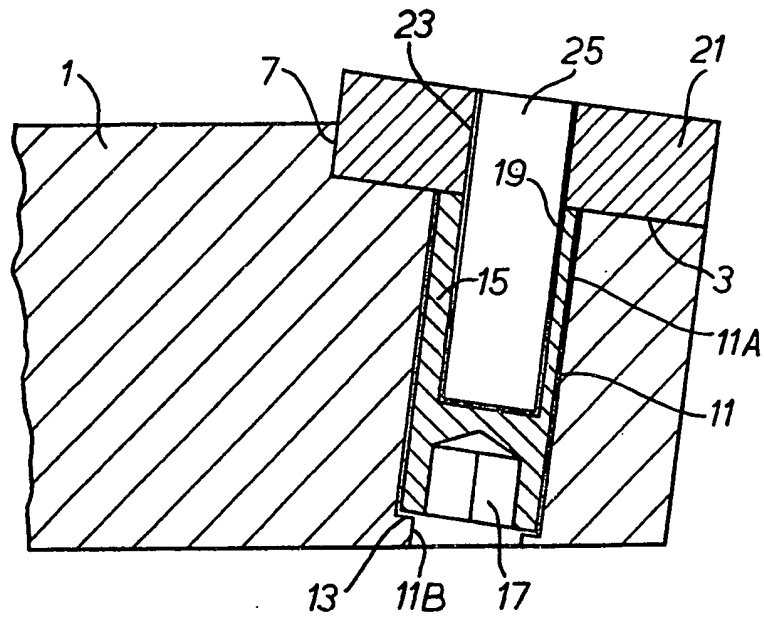


FIG. 2

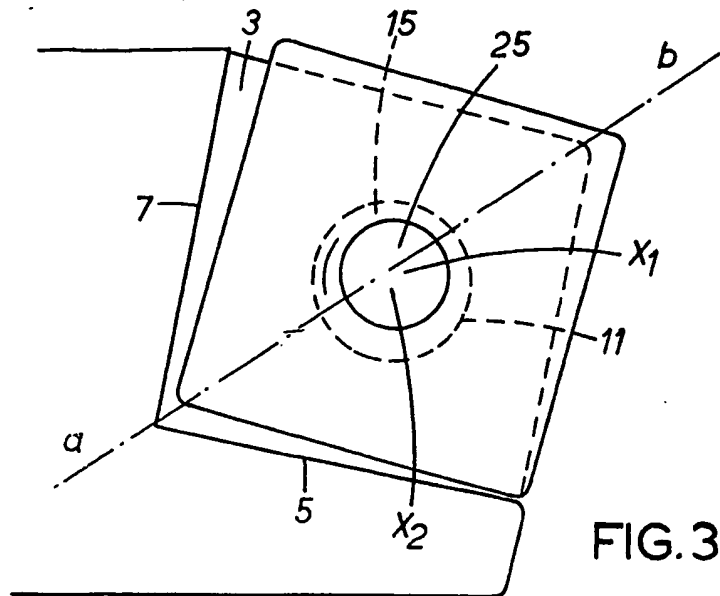


FIG. 3

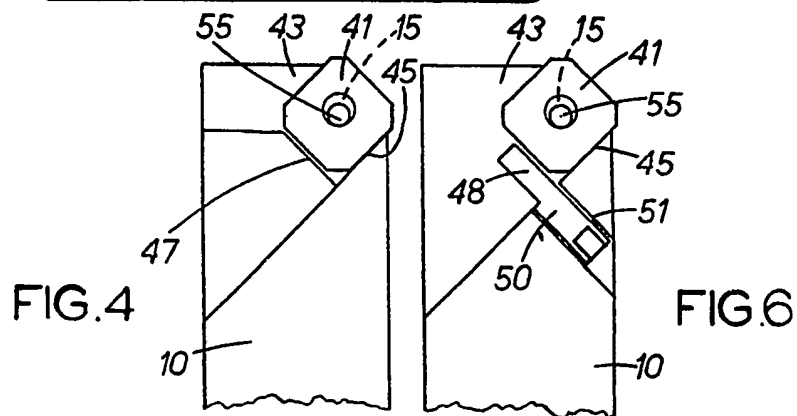


FIG. 4

FIG. 6

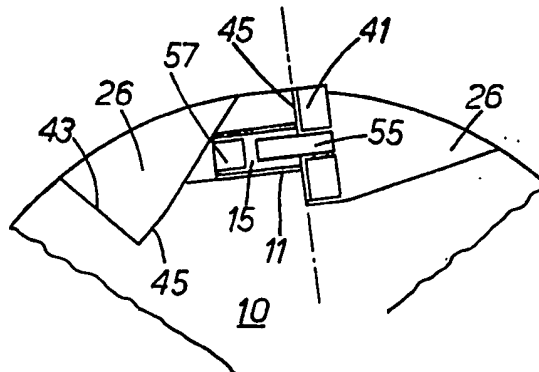


FIG. 5